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SUBSIDENCE OF OUTBREAK AT LOS ANGELES, CAL.

During the week ended September 14 no case of poliomyelitis was reported in Los Angeles. One case, however, was brought into the city from Chino and admitted to the municipal hospital.

A SQUIRREL DESTRUCTOR.**AN EFFICIENT AND ECONOMICAL METHOD OF DESTROYING GROUND SQUIRRELS.**

By JOHN D. LONG, Passed Assistant Surgeon, United States Public Health Service.

In May, 1912, after a careful study of the ground-squirrel situation in California, it seemed certain that the destruction of squirrels by means of poisoned grain and carbon bisulphide by the waste-ball method would be a long, tedious, and expensive process.

The use of poisoned grain while effective is faulty in one essential, namely, the cooperation of the squirrel himself must be obtained, i. e., he must eat the poison or place it in his cheek pouch to carry it to his burrow, and as this cooperation can not always be obtained the method fails to produce complete results. The reasons for this failure are probably as follows: Other natural foods, such as nuts, seeds, grasses, or at times vegetables and fruits, are obtainable and the poisoned grain is not taken; this factor is operative particularly in the wet season; hence the grain can be used most effectively during those months in which there is little or no rain, namely, July, August, September, October, and part of November. During the remainder of the year the results to be obtained by its use are not nearly so good.

Carbon bisulphide used by saturating balls of waste and exploding in the burrow is effective but expensive, and can be used only during the wet season when the ground is damp and will hold the gases of combustion. This substance can also be used by saturating balls of waste, placing in the burrow, closing the same, and allowing the gas to diffuse throughout the burrow. The men in the field, however, are of the opinion that this method is not as effective as where the gas is exploded.

From various observations that have been made, the conclusion has been reached that in order to obtain good results a given area of land must be gone over from four to five times with poisoned grain, preferably in the dry season, when no other food is available. The cost of this procedure is at least 35 cents per acre for all expenses. A few squirrels will, however, be left, and the next year, after the breeding season, these will have multiplied about eightfold.

The difficulty attendant upon destroying these remaining squirrels was recently shown in the Altamont section of Alameda County, where the inspector in charge, after exhausting all means of inducing the squirrels to eat the grain, finally destroyed them by placing a quantity of chlorinated lime in their holes and covering them up.

To effectually destroy squirrels with carbon bisulphide by the waste-ball method the land must be gone over twice at least, the

September 27, 1912

second time for the purpose of treating burrows found opened subsequent to the first treatment. The cost per hole, with bisulphide at 90 cents per gallon, has been found to vary from 3 $\frac{1}{2}$ to 4 or more cents. This, with an average infestation of 10 holes per acre, costs from 33.4 to 40 or 45 cents per acre for first treatment and from 20 to 30 cents for second treatment, a total cost per acre of from 61.7 to 75 cents.

This method, while efficient and positive in that the cooperation of the squirrel is not needed, has the drawback that it can not be used in the dry season, the reasons being that the force of the explosion when the gas is ignited dissipates it through cracks in the earth before sufficient time for diffusion has elapsed, and there is danger of producing extensive fires in grain fields, forests, etc. Its use, therefore, is limited to that season of the year when the ground is wet and free from cracks and when the vegetation is green and noninflammable.

In view of the above-mentioned considerations, I requested Passed Assistant Surgeons Currie and Simpson to participate in a discussion for the purpose of developing some other method of squirrel destruction which should possess the following requisites:

1. Efficiency.
2. Applicability during the entire year, without regard to season.
3. Low cost of construction, maintenance, and operation.
4. Light weight and easy operation.

Experiments were carried out at the Federal laboratory under our joint supervision, and trials were made with calcium carbide, chlorine, carbon tetrachloride, and other agents, with varying results.

Finally in attempting to assist the combustion of carbon bisulphide by pumping air into a burrow with a foot bellows the fire was extinguished without the operator's knowing it, but the guinea pig at the other end of the burrow died from the action of the gas resulting from the evaporation of the bisulphide. Numerous experiments were then made with fans run by dry cells and a motor, with fans run by hand, with a foot bellows, with hand bellows, etc., the idea being to effect the death of the animal with the least amount of bisulphide and in the minimum time.

As a result of the experience gained, I developed the pump shown in the illustrations. It meets the requirements previously outlined. The first two pumps were constructed, under my immediate direction, by Messrs. A. A. Patton and William Duncan. The weight of the pump loaded with 9 pints of bisulphide, the capacity of the reservoir, is 25 pounds. The amount of bisulphide required for each hole is 15 c. c. (one-half ounce).

Refined bisulphide only is used in the apparatus, as it was found that the sulphuretted hydrogen, sulphuric acid, sulphur, etc., in solution in the crude bisulphide rapidly corroded the metal. The price per gallon is the same as the crude. It contains carbon bisulphide, 99.92 per cent; sulphur in solution, 0.08 per cent. It contains no hydrogen sulphide or sulphuric acid.

The apparatus is used as follows: Insert the hose in the squirrel hole at least 1 foot; then run one-half ounce of bisulphide from the reservoir into the measuring cup; then turn cock with handle down to allow liquid to run into vaporizing chamber, meanwhile cover-

ing hole with dirt with the aid of a mattock. Then pump 30 strokes. This equals 12 cubic feet of a 1.5 per cent bisulphide gas. Withdraw the hose, close hole opening by stamping in the dirt with the heel and proceed to the next hole. The whole operation of inserting the hose, measuring the bisulphide, covering the hole, and pumping in the gas requires from 45 seconds to 1 minute and 10 seconds, depending upon the hardness of the ground. The average time is about 1 minute per hole.

Laboratory experiments show that the animal is but little disturbed by the gas. He makes no effort to escape, does not struggle nor seek fresh air, and in from 10 to 15 minutes after the gas is pumped in falls over, and in from 30 to 45 minutes is dead.

Of the few holes opened by squirrels after treatment a number show indications of having been opened from the outside, the presumption being that the animal was absent when his burrow was treated and returned later and dug it open.

The cost per individual hole treated is as follows:

One-half ounce carbon bisulphide, at 90 cents per gallon.....	\$0.0035
Labor, at \$75 per month (1 minute).....	.0060
	.0095

Our experience so far indicates that a man can average about 40 holes per hour in heavily infested ground, and about 30 holes per hour taking the ground as it comes. About 95 per cent of the holes have remained closed after the first treatment. The 5 per cent that are opened are treated in a few days, or a week later, by one or two men sent to look over the land for this purpose.

The cost therefore will be about as outlined below, but further and more extensive work will be needed to establish a fair average cost.

Cost per acre, infestation 10 holes per acre.

Squirrel destructor :

First time.....	\$0.15
Second time.....	.05
	.20
Poisoned grain.....	.35
Carbon bisulphide, waste-ball method.....	.68

The men using the pump have been able to treat from 200 to 250 holes with each gallon of bisulphide, whereas with the waste-ball method from 50 to 60 holes per gallon is considered good.

The apparatus is made principally of galvanized iron, 18 gauge, and can be constructed in quantities for about \$10 for each machine.

The total equipment needed for each man is a pump and a mattock for closing holes.

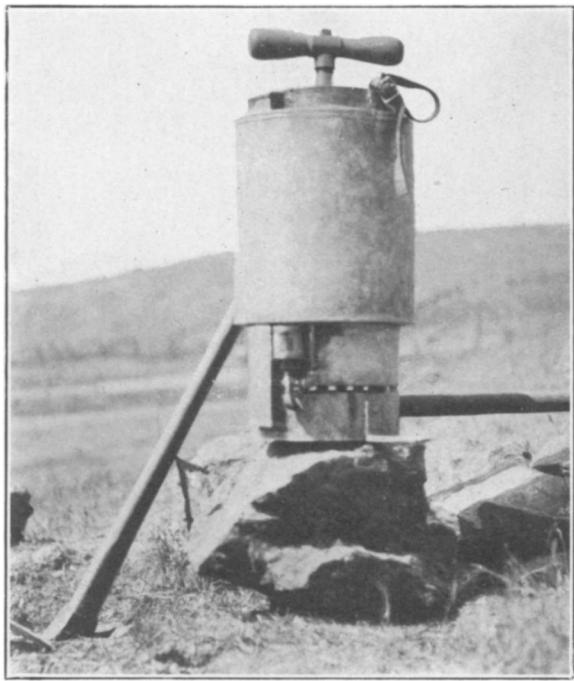


FIG. 1.—THE SQUIRREL DESTRUCTOR. NOTE MEASURING DEVICE AND THREE WAY COCK UNDER RESERVOIR. WEIGHT OF MACHINE, READY FOR USE AND WITH 1½ GALLONS OF CARBON BISULPHIDE IN RESERVOIR 25 POUNDS. (United States Public Health Service



FIG. 2.—MAN WITH OUTFIT LOOKING FOR SQUIRREL BURROWS. COMPLETE OUTFIT CONSISTS OF A SQUIRREL DESTRUCTOR AND MATTOCK. (United States Public Health Service.)



FIG. 3.—DESTRUCTOR READY FOR USE, SHOWING HOSE INSERTED IN BURROW AND OPERATOR MEASURING OFF ONE-HALF OUNCE OF CARBON BISULPHIDE. (United States Public Health Service.)



FIG. 4.—OPERATOR CLOSING THE MOUTH OF THE BURROW AROUND THE INSERTED HOSE WHILE THE CARBON BISULPHIDE IS RUNNING INTO THE VAPORIZING CHAMBER. (United States Public Health Service.)



FIG. 5.—OPERATOR PUMPING 30 STROKES AND THEREBY FORCING INTO BURROW 12 CUBIC FEET OF A 1.5 PER CENT VAPOR OF CARBON BISULPHIDE. (United States Public Health Service.)



FIG. 6.—OPERATOR CLOSING WITH HEEL THE HOLE LEFT
IN THE BURROW MOUTH BY WITHDRAWAL OF HOSE
(United States Public Health Service.)

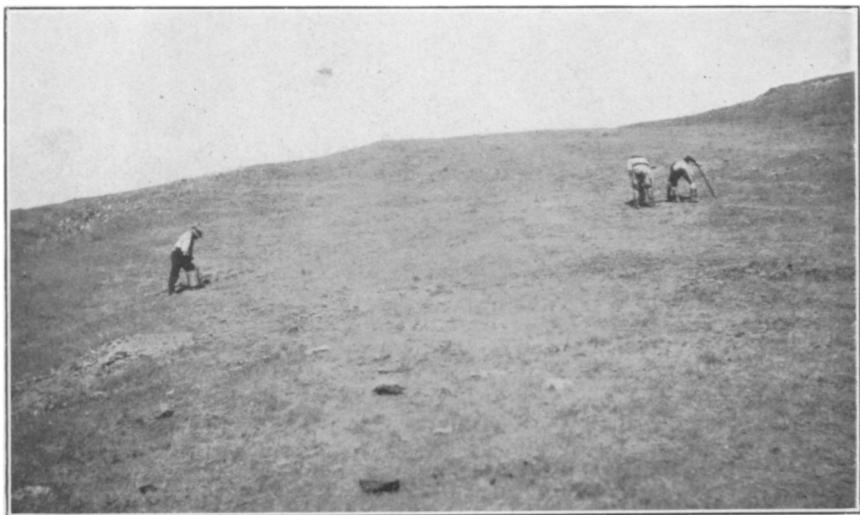


FIG. 7.—OPERATORS AT WORK WITH SQUIRREL DESTRUCTORS IN CALIFORNIA
(United States Public Health Service.)